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(71) Applicants  
Oy Partek AB,  
SF—21600 Parainen,  
Finland  
(72) Inventor  
Kauko Ensio Junkkarinen  
(74) Agents  
Carpmaels & Ransford,  
43 Bloomsbury Square,  
London WC1A 2RA
- (54) **Production of building board by the take-up method**
- (57) A building board is manufactured by the take-up method, using ground cellulosic and/or wastepaper fibres as carrier fibres, waste gypsum in dihydrate form as a filler and hydraulic cement as a bonding agent. Optional additives such as blast furnace slag are also described.

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## SPECIFICATION

## Production of building board by the take-up method

The present invention relates to the production of building board by the take-up method, using ground cellulosic and/or waste paper fibers as carrier fibers in the wet pulp for building board, waste  
 5 gypsum in dihydrate form as the filler, and hydraulically setting cement as the bonding agent, as well as additives. 5

From British Patent 1,584,046 it is known to produce asbestos-free building board by the take-up method, in which there are used unbeaten, or unground, cellulosic and/or waste paper fibers as carrier  
 10 fibers in the wet pulp, cement as the bonding agent, and in addition to certain other materials, gypsum, which at the early stages of the process is in part or entirely in the form of semi-hydrate. According to  
 10 the method, the process is, however, allowed to continue until practically all of the semi-hydrate is converted to dihydrate before the wet pulp is taken up as board. 10

The object of the present invention is to use waste gypsum for the production of fire-resistant building boards by the take-up method. Gypsum waste is becoming a real problem, since in certain  
 15 branches of industry, such as the phosphate industry, it is produced in millions of tonnes. Exploitation of such an amount of waste is of great economic significance. 15

Attempts have been made even previously to use waste gypsum for the production of asbestos-free building boards by the take-up method. However, this method has not been successful when only  
 20 unground carrier fibers have been used, since such fibers do not keep the ingredients of the wet pulp, especially waste gypsum and the bonding agent, evenly cohesive. Cohesion is, however, necessary,  
 especially when the take-up method is used. 20

It has been observed in experiments that specifically the grinding of cellulosic fibers enables waste gypsum to be used in building boards, even though waste gypsum itself is not a bonding agent. Grinding  
 25 causes 'felting', i.e. a structure in which the fibers, adhering to each other, form cavities. When these cavities are filled with some compressed material, which need not be chemically bonded, a surprisingly  
 25 rigid structure is produced. This material can be waste gypsum, which thus serves only as a filler. This phenomenon can be due to surface forces effective between the particles, the Van der Waal force or  
 other similar forces, which keep the particles cohesive in the cavities. Very good boards, suitable for interior surfacing, can be produced by this method. 25

The mechanism which keeps the board cohesive is not precisely known. Of course, the strength of  
 30 the building board thus obtained is not as high as the strength of board produced using known bonding agents; nevertheless, it is surprisingly good. However, as such the board is not waterproof but dissolves in water. For this reason, an amount of hydraulically setting cement must be added to the pulp. The  
 purpose of the cement is thus not to produce a structure which enables forces to be transmitted, since  
 35 this is already achieved by means of the ground cellulosic fibers and waste gypsum. Since the purpose of the cement is only to prevent the board from dissolving, its proportion can be minimized. The amount  
 of cement is, of course, substantially dependent on the other ingredients used, especially the waste  
 gypsum. 35

By proportioning the degree of beating of the fibers and the amounts of gypsum and cement in  
 40 relation to each other in the correct manner found through experiments, a board is obtained which is waterproof and has satisfactory strength properties. Since the proportion of cement can be minimized, the proportion of gypsum, which is important in terms of fire-resistance, can be maximized. In this  
 manner a use has also been found for waste gypsum. 40

According to the present invention, when building boards are produced from waste gypsum,  
 45 beaten cellulosic and/or waste paper fibers are used as carrier fibers, the degree of grinding must be relatively high, 20—75 °SR (Schopper-Riegler). The proportion of hydraulically setting cement is selected between 15 and 50% of the total weight of the dry matter of the board. The proportion of  
 cement to be used depends on the degree of grinding of the cellulosic fibers. Since uncalcinated waste  
 gypsum does not bond hydraulically, the use of cement is important. In the method according to the  
 50 invention, it is also important that the degree of grinding of the carrier fibers and the amounts of gypsum and cement are proportioned to each other in an advantageous manner in order to achieve optimal  
 results. The cement can be Portland cement. 50

The characteristics of the invention are given in the accompanying claim. According to it, blast-furnace slag and fly dust, as well as diatomite, perlite, vermiculite, pulverized limestone or the like,  
 55 mineral fibers, glass fibers, glasswool, rockwool and slagwool or the like, and organic fibers such as sisal, hemp and plastic fibers or the like, and flocculants are used for the building board in addition to the previously mentioned substances, in the proportions indicated in the claim. 55

Building board which has been produced by the method according to the invention and in which uncalcinated waste gypsum is used has fully satisfactory strength properties, even though all of its  
 60 strength values are not of the same order as those of boards previously produced. 60

By the method according to the invention it is, of course, also possible to manufacture building boards in which the basis material is uncalcinated raw gypsum instead of waste gypsum.

The following table shows, for comparison, some test results illustrating the strength properties of building boards produced by the method according to British Patent 1,584,046 and the strength



13. A process for the production of building board by the take-up method, using ground cellulosic and/or wastepaper fibres as carrier fibres in the wet pulp for the board, waste gypsum in dihydrate form as the filler, and hydraulically setting cement as the bonding agent, as well as additives, the ingredients being used in the following proportions, calculated from the total weight of the dry matter of the board:

5	waste gypsum in the form of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	20—80%	5
	hydraulically setting cement	10—50%	
	blast-furnace slag, fly dust	at max. 50%	
	diatomite, perlite, vermiculite, pulverized limestone, or the like	at max. 50%	
	cellulosic and/or wastepaper fibres, degree of grinding 20—75 °SR	5—30%	
10	mineral fibres, glass fibres, glasswool, rockwool, slagwool, or the like	at max. 15%	10
	organic fibres: sisal, hemp, plastic fibres or the like	at max. 15%	
	flocculants	at max. 200 ppm	